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Schrier et al.

[11] **3,917,265**

[45] **Nov. 4, 1975**

[54] **PNEUMATIC BALL EJECTING MACHINE**

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[73] Assignees: **Michael Robert Schrier; Jack Michael Eichner; Martin S. Sachs; Marvin Reich,** all of Washington, D.C.

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[21] Appl. No.: **340,508**

[52] **U.S. Cl.** ..... **273/30;** 124/51 A; 124/11 R; 124/48; 124/30 R

[51] **Int. Cl.** **F41f 1/04**

[58] **Field of Search** ..... 273/29 A, 26 R, 26 D, 129, 273/30, 35 R, 201; 124/11 R, 45, 51 R, 51 A, 41, 48; 302/2 R

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Primary Examiner—Richard C. Pinkham
Assistant Examiner—T. Brown

[57] **ABSTRACT**

A pneumatic ball ejecting machine is provided which collects tennis balls which are returned to a common area. The tennis balls are returned to a pneumatic lifting means which lifts the balls one at a time. The balls are loaded one at a time into a chamber at a loading station. The chamber is rotated to an ejection position where the ball is ejected by a blast of air through a barrel which imparts a spin to the ball.

18 Claims, 20 Drawing Figures

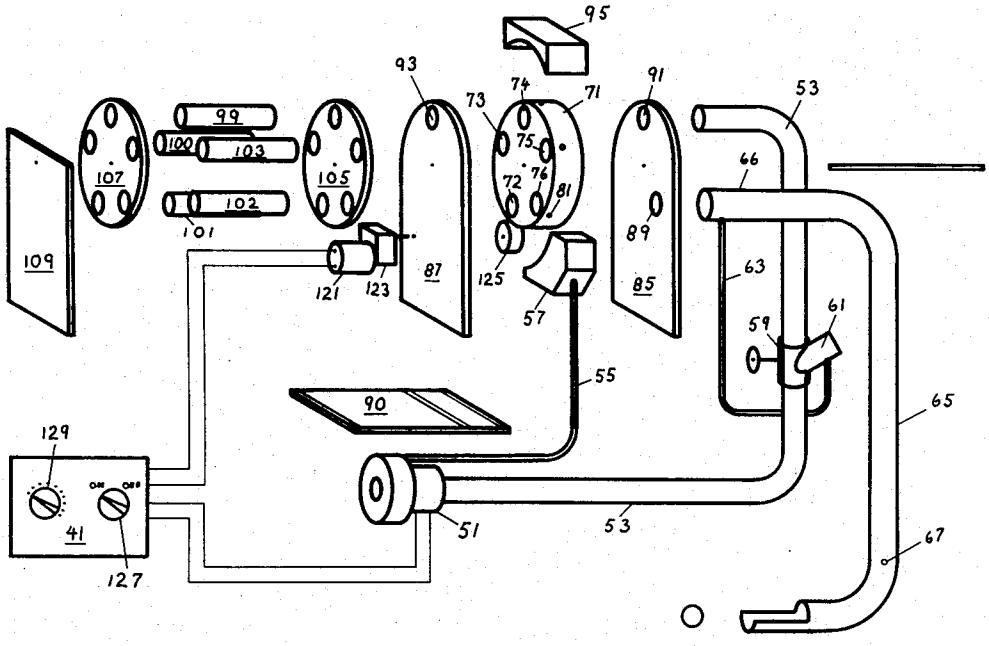


FIG. 1

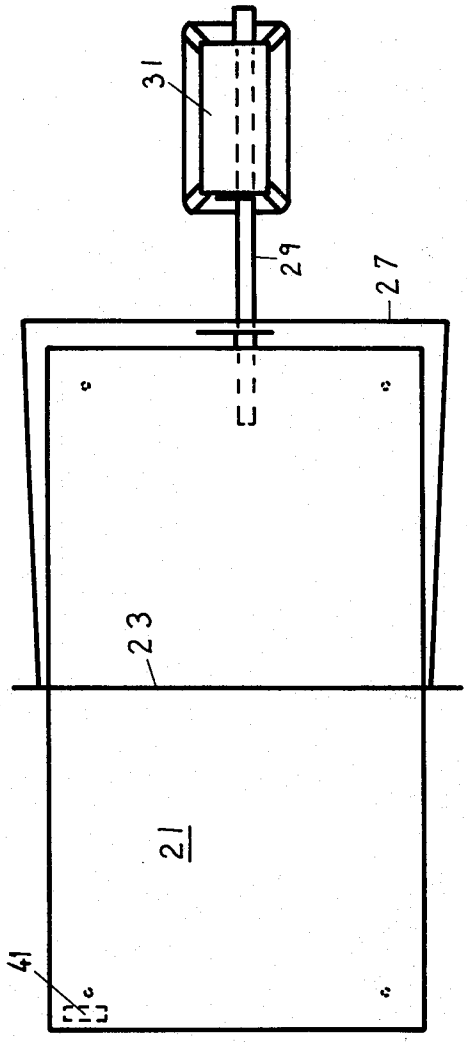
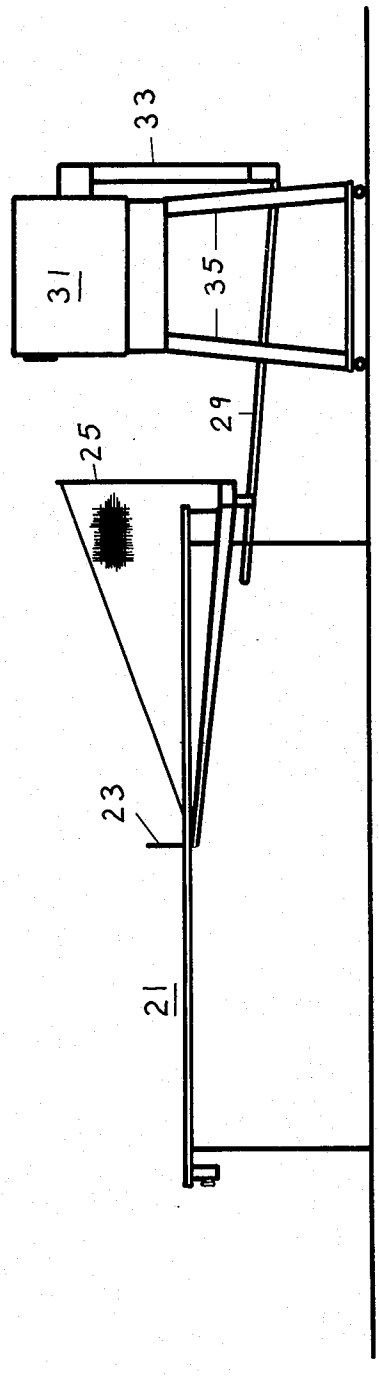


FIG. 2



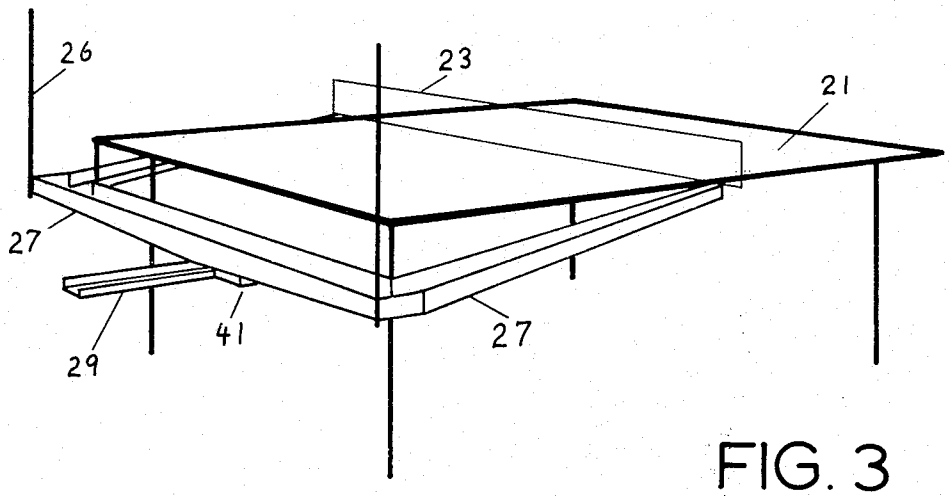


FIG. 3

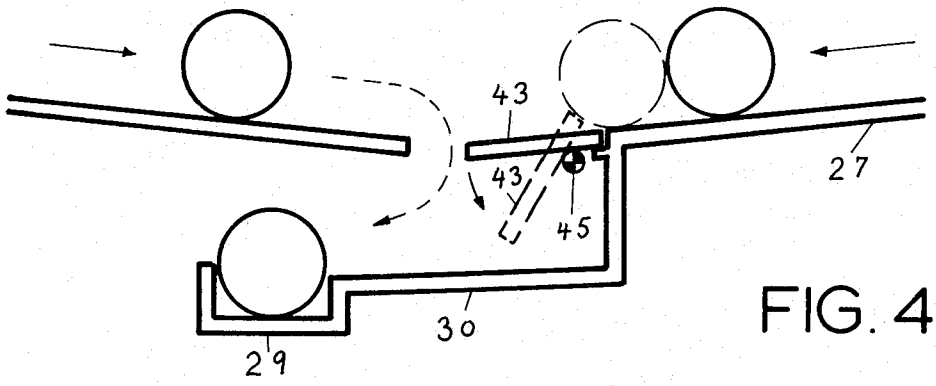


FIG. 4

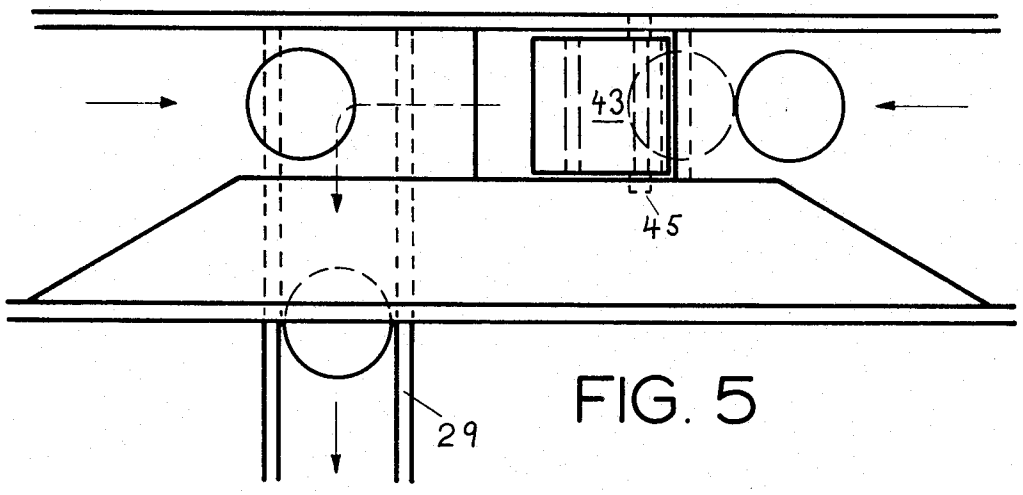


FIG. 5

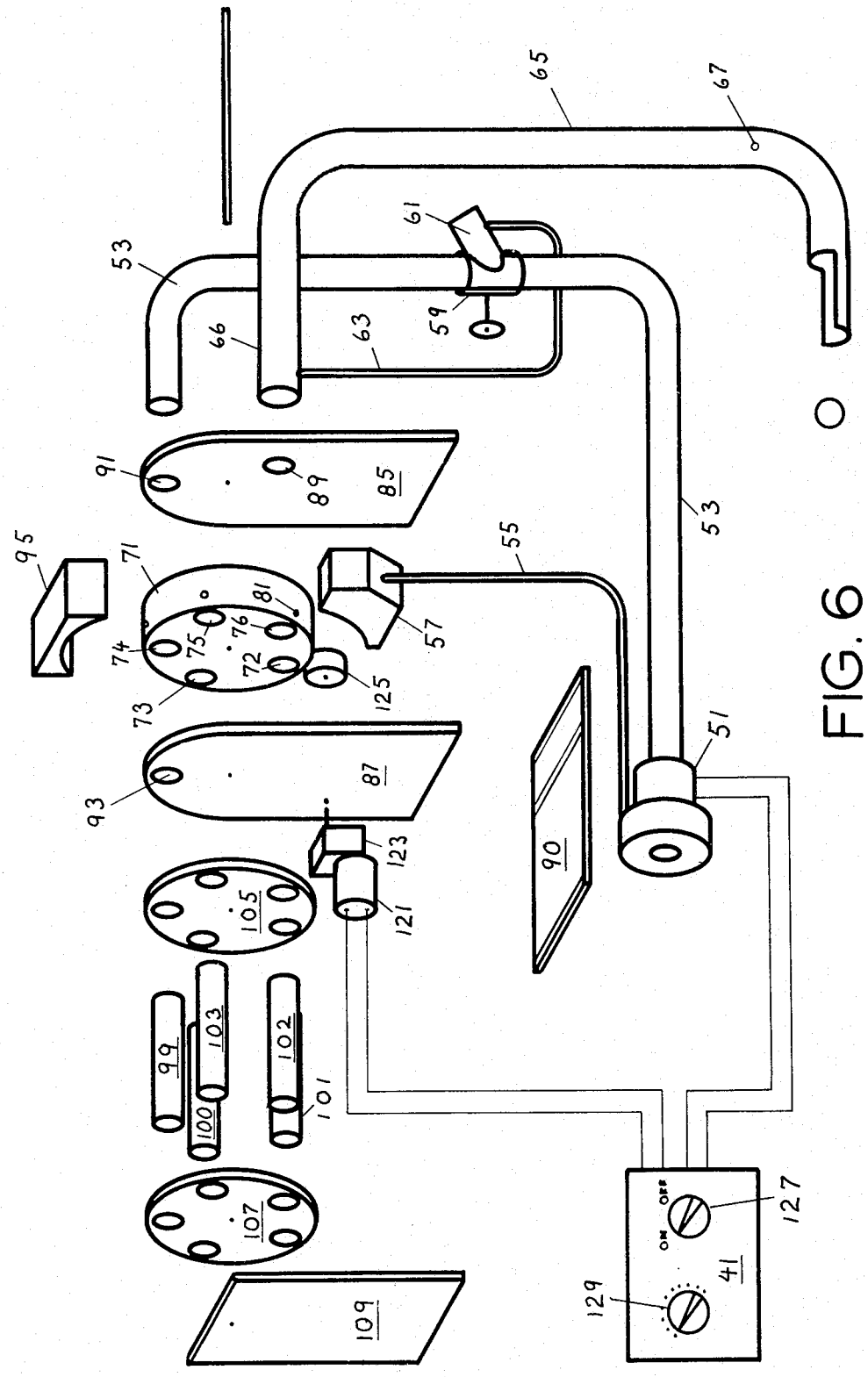

65
67
61
53
59
63
66
91
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85
95
71
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53
81
76
75
74
72
57
125
73
87
93
51
90
123
121
105
99
103
102
100
101
107
109
OFF
ON
127
41
129

FIG. 6

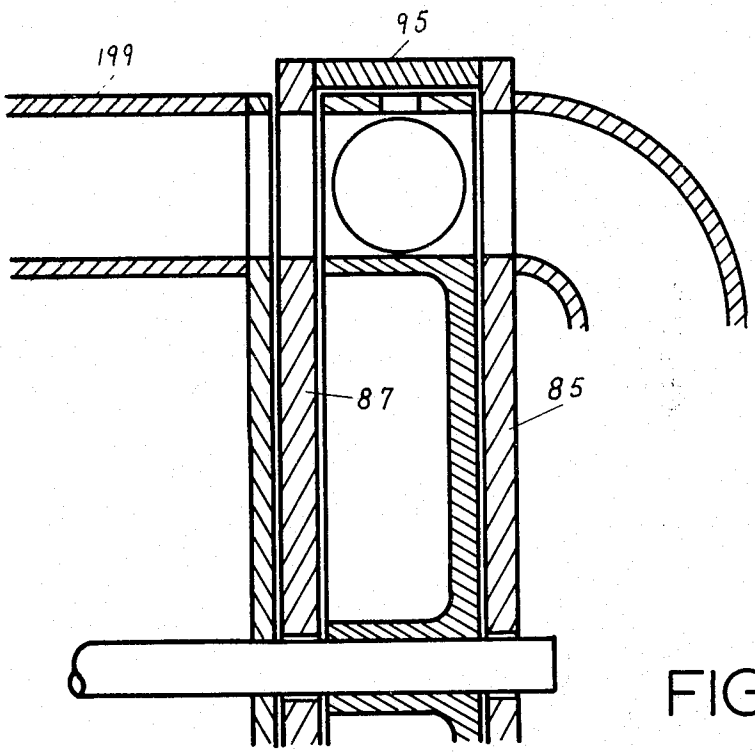


FIG. 8

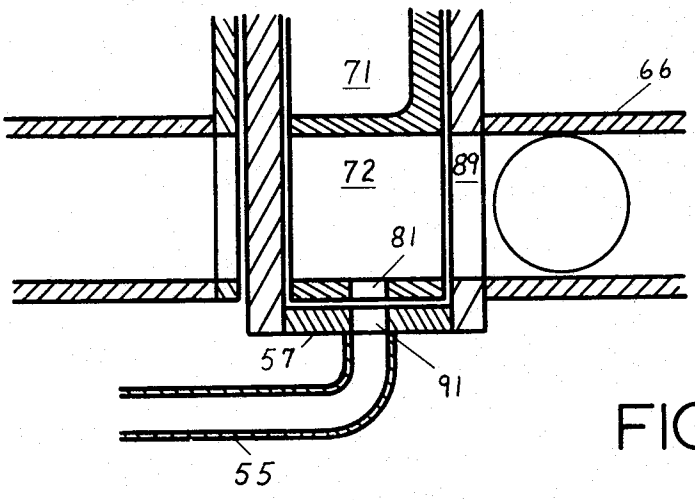


FIG. 7

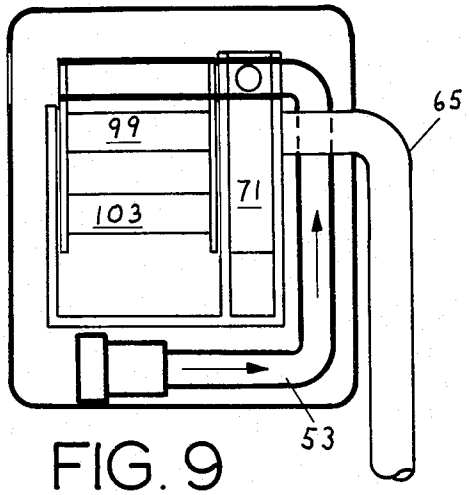


FIG. 9

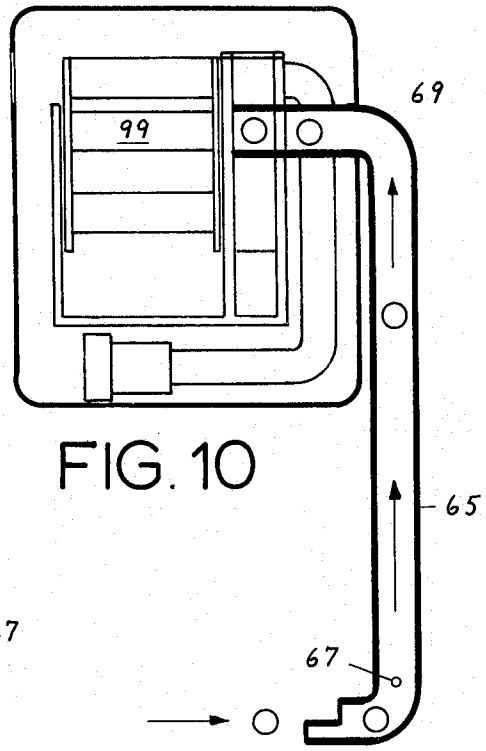


FIG. 10

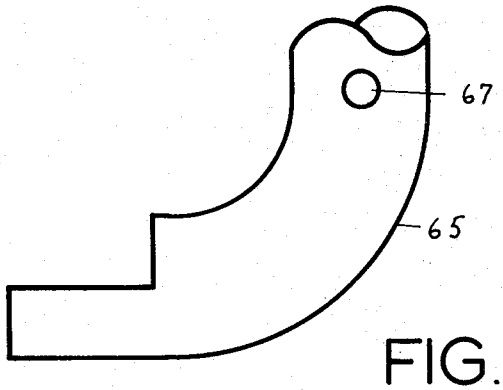


FIG. 11

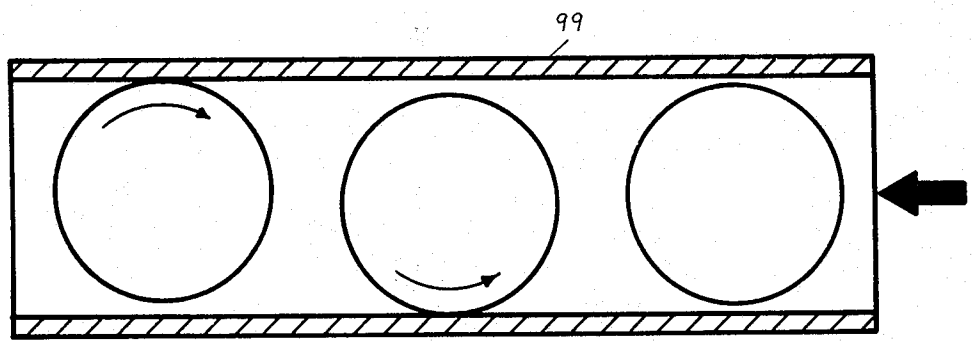


FIG. 12

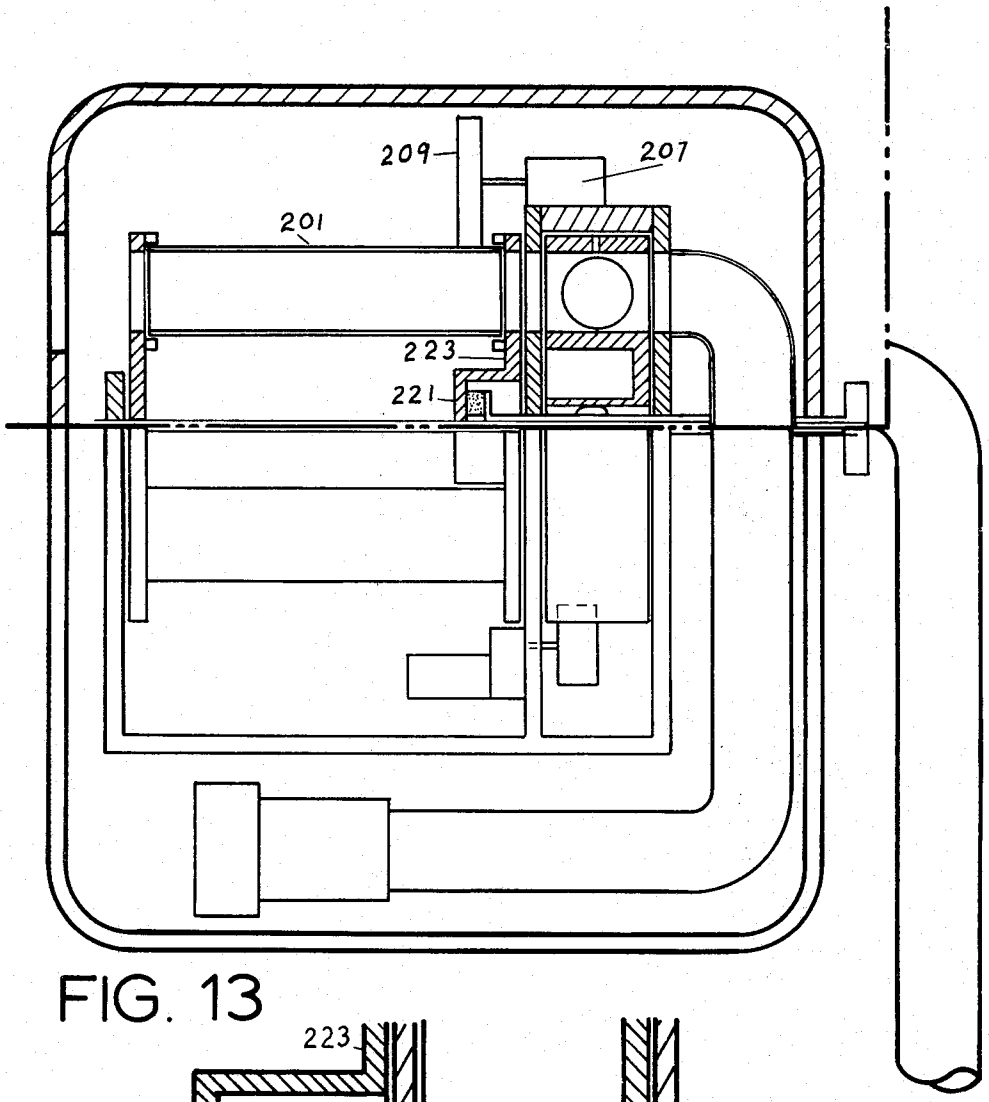


FIG. 13

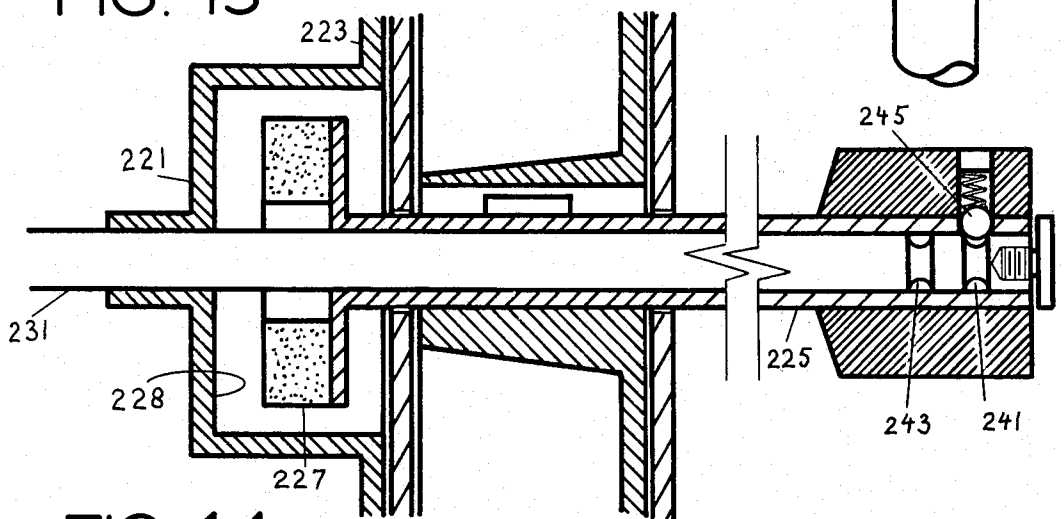


FIG. 14

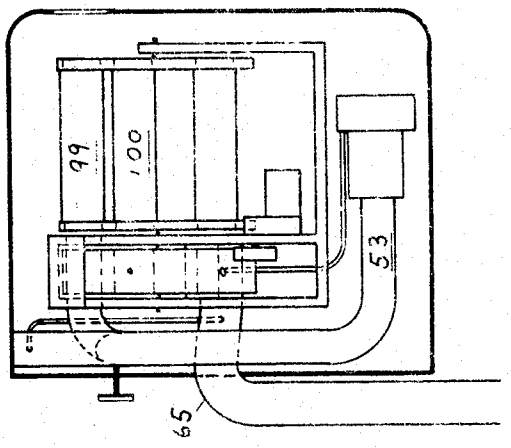


FIG. 15d

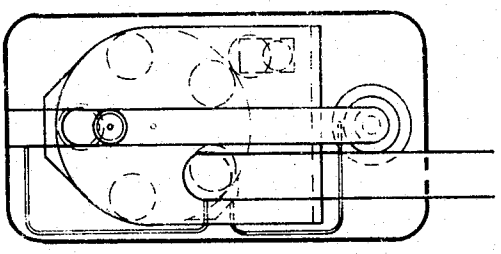


FIG. 15c

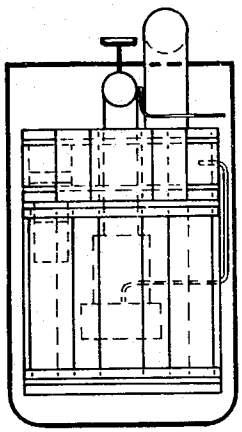


FIG. 15e

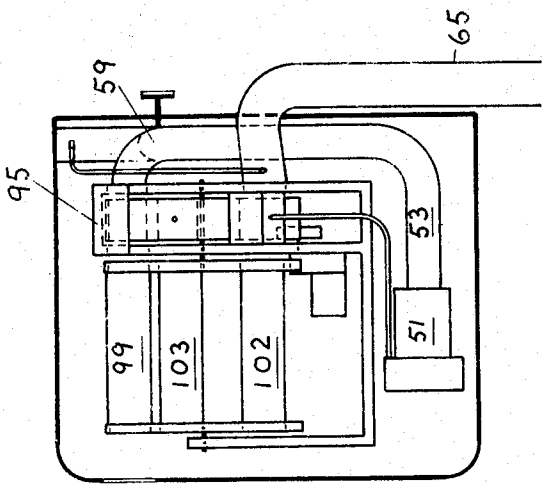


FIG. 15b

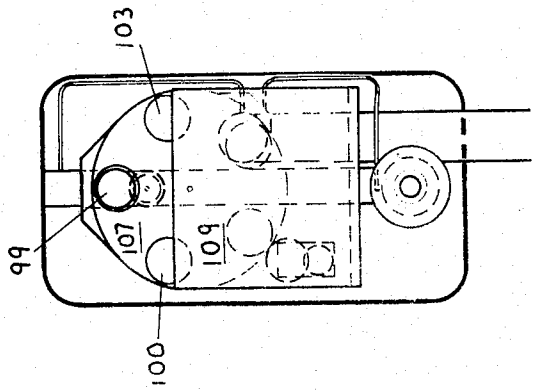
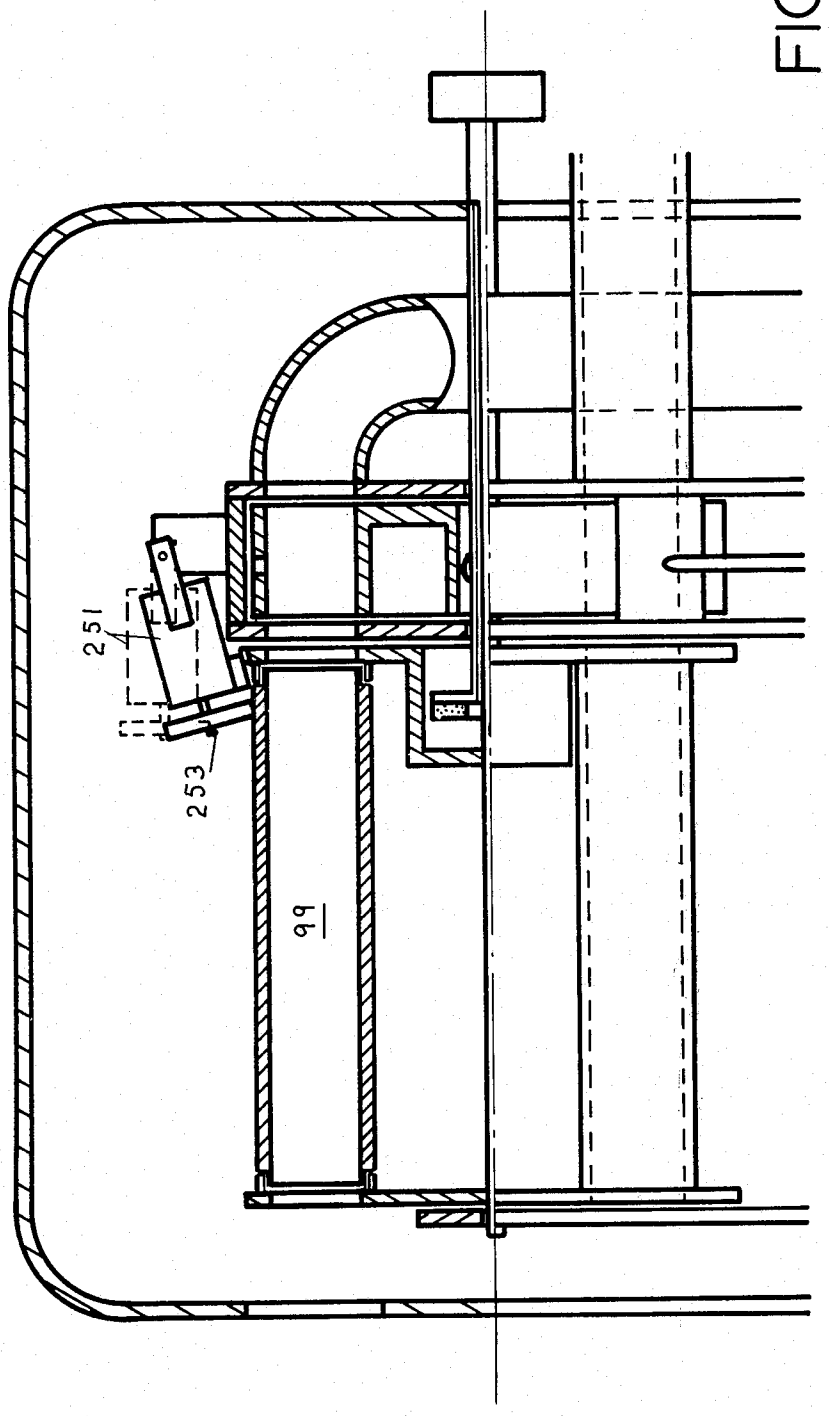


FIG. 15a

FIG. 16



PNEUMATIC BALL EJECTING MACHINE

The invention relates to a ball ejection machine and, more particularly, to a ball ejection machine which pneumatically loads balls by suction and ejects the loaded ball by a blast of air.

In summary, the prior art contains many ball ejecting machines which generally operate satisfactorily. However, these machines contain one or more limitations such as they are expensive to manufacture and are consequently costly to the consumer. The machines jam up in use, wear out the tennis balls, have a limited number of delivery trajectories, velocities and spins, and are generally unsuitable for the average homes.

The invention provides a unique ball delivery and return system for table tennis and similar ball games enabling a single player to play the game. An attachment is provided at the far end of a table, which comprises a net and associated collecting means, ball storage and delivery means, and power actuated ball delivery means, comprising means to impelling a ball sharply in an horizontal manner through various cylindrical barrels. The speed, direction and trajectory of the ball may be altered by making various adjustments to the delivery mechanism to satisfy the personal needs of each individual player.

The invention provides a unique and improved ball delivery and returning device whereby a player can practice to gain expertise or play for amusement. Upon activating the ball delivery means, a ball or succession of balls are automatically propelled at different spins and directions toward the player at the opposite end of the table. The returned bouncing or rolling ball is restrained within the confines of the return sector of the table by a returning device comprising a net that is positioned directly opposite the player. Upon impact with the net, the ball rolls back to the collecting device under the table and is automatically stored for recycling.

An object of the invention is to provide a table tennis ball delivery machine that will not jam or clog.

Another object of the invention is to provide a table tennis ball ejecting machine which is reliable and inexpensive to manufacture.

A further object of the invention is to provide a delivery device that can be adjusted to alter the speed, direction and trajectory of the propelled ball.

Still another object of the invention is a simple method of automatically collecting a number of balls and storing the balls in a storage chute adjoining the ball ejection device.

Other objects and many of the intended advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

FIG. **1** is a top view of a tennis table equipped with the inventive ball ejecting mechanism, a catching means and a ball return means;

FIG. **2** is a side view of FIG. **1**;

FIG. **3** illustrates, in perspective, the details of the ball return means utilized in the present invention;

FIG. **4** is a side view of a mechanism for preventing the jamming of the ball return mechanism utilized in the present invention;

FIG. **5** is a top view of FIG. **4**;

FIG. **6** illustrates the ball loading and ejecting mechanism of the present invention;

FIG. **7** illustrates a tennis ball being sucked into the magazine of the present invention;

FIG. **8** illustrates the magazine in the ejecting mode with a ball in position to be ejected;

FIG. **9** illustrates the air return and delivery system utilized in the present invention;

FIG. **10** illustrates the ball return mechanism utilized in the present invention;

FIG. **11** illustrates the means that assures that only one ball will be lifted at a time;

FIG. **12** illustrates the passage of a table tennis ball through the barrel of the present invention;

FIG. **13** illustrates a modified ball ejecting means that may be utilized in the present invention;

FIG. **14** illustrates a clutch mechanism for use in the present invention;

FIG. **15***a* illustrates a front view of the ball ejecting machine of the present invention;

FIG. **15***b* illustrates a first side view of the ball ejecting machine of the present invention;

FIG. **15***c* illustrates a back view of the ball ejecting machine of the present invention;

FIG. **15***d* illustrates a second side view of the ball ejecting machine of the present invention;

FIG. **15***e* illustrates a top view of the ball ejecting machine of the present invention; and

FIG. **16** illustrates a second variation of the modification of the ball ejecting machine of the present invention.

Referring to FIGS. **1, 2** and **3,** wherein a table **21** is provided with a table tennis net **23.** The table is provided with a ball catching net **25** which catches the returned table tennis ball. A ball return trough **27** surrounds the table **21.** The net **25** is connected to the trough **27** to assure that the returned table tennis balls drop into the trough **27.** The ball return trough **27** is positioned over the trough **29** which leads the table tennis balls to the ball lifting means **33** of the ball ejecting machine **31.** The details of machine **31** and ball lifting means **33** will be hereinafter discussed in greater detail. The ball ejecting machine **31** is mounted on legs **35.** Controls **41** for controlling the operation of the ball ejecting machine **31** are mounted on the edge of the table **21.**

Referring to FIG. **3,** wherein common elements illustrated in FIGS. **1** and **2** contain the same numerical indicia and perform the same functions as heretofore described.

The ball return trough **27** is sloped to cause the table tennis balls to return to the center point **41** where a jam preventing means is located.

FIGS. **4** and **5** illustrate the details of the jam preventing means located at point **41.** A trap door **43** is provided which is designed to be in the closed position. To this end a non-illustrated spring assures that the trap door **43** remains closed. Alternately the trap door **43** may be weighted and balanced so that it returns to its original position due to the force of gravity. Trap door **43** is designed to give table tennis balls arriving from the left priority over table tennis balls arriving from the right which are automatically backed up behind the trap door **43.** After the last left table tennis ball falls through the trap door **43,** the trap door **43** returns to the horizontal position which is the closed position permitting a table tennis ball from the right to roll onto the trap door **43.** The ball opens the trap door **43** permit-

ting the ball to fall to trough **30.** The weight of the table tennis ball is sufficient to open trap door **43.** Trough **30** is connected to trough **29.** The remaining table tennis balls continuously operate the trap door **43** until the last table tennis ball enters return trough **29.**

Referring to FIG. **6,** which shows the details of the ball return loading and ejecting means. A fan **51** which may be a turbine fan or any other high capacity fan, is connected to an exhaust or pressure line **53.** The fan **51** is also connected to a suction line or vacuum line side **55.** The free end of vacuum line **55** is connected to a boot **57.** The air exhaust or pressure line **53** is provided with a valve **59** and a venturi **61** for creating a suction or vacuum in line **63.**

Suction line **63** is connected to ball return line **65** for creating a lifting force in ball return line **65.** A hole **67** is provided as a means to assure that only one ball will be lifted into the vertical section of the ball return line **65.** It is important to note that when a ball is above the hole **61** insufficient vacuum remains below the hole **67** to lift a second ball.

Referring to FIG. **7,** which illustrates an exploded view of the magazine **71** as well as FIG. **6.** The magazine **71** is provided with a series of chambers **72, 73, 74, 75** etc. Each of the chambers **72** etc., in the magazine is provided with a hole **81** which aligns itself with a hole **91** in the boot **57.** In operation the suction in vacuum line **55** provides a suction force on the table tennis ball in the return line **65** causing the ball to enter the chamber **72.** The magazine **71** is provided with a back cover plate **85** and a front cover plate **87** which contains the loaded balls in their respective chambers. The hole **89** is provided in the back cover plate **85** to permit the balls to be sucked into the respective chambers of the magazines. The front cover plate **87** and the back cover plate **85** are mounted on the bottom plate **90.**

Referring to the ball ejecting position of the machine illustrated in FIGS. **6** and **8,** we have illustrated a ball in chamber **74** which is ready to be ejected. The hole **93** in front cover **87** is axially aligned with the hole **91** in back cover **85** to permit the ball to pass through the front cover when an ejecting force enters by way of the hole in the back cover. A sealing member **95** is provided for covering the respective holes **81** thereby avoiding an air leak at this point. The velocity of the ejected table tennis ball may be varied by varying the air pressure in line **53.** This may be done by opening the valve **59** or by any other suitable means.

The barrels **99** through **103** are mounted in a unit between barrel covers **105** and **107.** Each of the barrels are mounted at a slightly different angle to provide different trajectory for the ejected balls. A front cover plate **109** is also fixedly mounted to the base member **90.** A motor **121** is provided with reduction gear box **123** which has an output that turns a friction drive wheel **125.** The on-off switch **127** for motor **121** and fan **51** is mounted on control unit **41.** The speed selection dial **129** controls the speed of rotation of motor **121.**

Referring to the operation of FIG. **6** during which reference will be made to FIGS. **7** through **12.** Turning on the machine supplies power to the machine causing the motor **121** to rotate the magazine **71,** and to rotate the barrels **99** through **103** between cover plates **107** and **109.** The fan **51** creates an exhaust pressure in line **53** and a suction or vacuum in line **55.** Part of the exhaust air is ejected through the venturi **61** creating a suection or vacuum in line **63.**

In the discussion of the ball return means, reference will be made to FIGS. **6, 10** and **11.** As illustrated in FIG. **10,** balls arriving at the bottom of ball return means **65** will remain on the bottom as long as a ball is in the lifting stage as illustrated. As soon as a ball reaches the top portion of the ball return **66** then another ball will be lifted. The hole **67** assures that insufficient air vacuum exists to lift a new ball as long as one is being lifted. In an actual working embodiment, the hole **68** was made three-eighths of an inch in diameter. It is to be noted that a ball being lifted above the hole **67** reduces the vacuum below it. The reduction in vacuum at the hole in combination with the permitted entrance of air at the hole prevents a second ball from being sucked up past the hole **67.** As soon as the ball being lifted passes bend **69** the suction increases to the point that a new ball is drawn into the lifting cycle. This lifting means assures the absence of jamming which would occur when a plurality of balls arrive one after another and are suspended in the return means **65** without any of them ever reaching the top **66.**

A ball waiting at the top **66** will be sucked into an empty chamber in magazine **71** when it arrives in the loading position as follows. The ball is sucked into the chamber **76** by the vacuum in line **55** through boot **57** by way of holes **81** and **91.** The ball is sucked in so rapidly that the magazine **71** keeps on rotating and does not need to be stopped.

When a loaded chamber, illustrated as chamber **74,** reaches the top position as illustrated in FIGS. **6** and **9,** the air pressure in line **53** causes the ball to be ejected. The diameter of the barrels is slightly larger than the diameter of the balls as illustrated in FIG. **12.** The ejected ball is caused to ride on the bottom, top and sides of the barrel and is also caused to be bounced about in the barrel, thereby imparting a spin to the ball as it traverses the barrel. Since the spin is imparted to the ball by riding on the sides of the barrel, the machine ejects the balls with an infinite variety of spin. It is emphasized that each barrel is pointed in a slightly different direction thereby ejecting the balls at different spins and directions. The time interval that elapses between balls is controlled by varying the speed of the rotating motor **121.**

Referring to the modified ball ejecting machine illustrated in FIGS. **13** and **14,** there is provided a barrel **201** which is mounted at both its ends in a fashion which permits the barrels to be rotated about its central axis by motor **207** which drives a friction driving gear **209.**

The embodiment illustrated in FIG. **13** contains a clutch mechanism **221** which permits one to stop the rotation of the barrels so that only one barrel will remain in the firing position. The details of the clutch are illustrated in FIG. **14.** The barrels are connected to the perimeter of the element **223.** The clutch contains a slidable hollow shaft **225** which is keyed to shaft **231** and rotates with shaft **231.** The clutch is shown in its disengaged position where it is held by detent **241** and ball **245.** When the keyed hollow shaft **225** is shifted to the left, a dry rubber element **227** is compressed against bearing surface **228,** causing the unit **223** to rotate. When the shaft is shifted to the left the detent ball **245** will ride in the left detent **243.** With the clutch in the left position, the barrels will be continuously changed whereas, when the clutch is in the right position, the barrels will not be changed and only one barrel will be in the firing position. When a single barrel is

held in the firing position, all the ejected balls will land in the same area on the table enabling the user to continuously practice a single shot.

In FIG. **16** the motor **251** is shown in solid lines in the engaged position, wherein a friction gear **253** causes the barrel in the firing position to be rotated about the central axis of the barrel. The motor **251** may be rotated to dashed line position wherein the barrels will not be rotated.

Having thus described the invention as exemplified by a preferred embodiment, obvious changes and modifications by persons skilled in the art are deemed to fall within the spirit and scope of the disclosure and appended claims.

What is claimed is:

1. Apparatus for projecting a ball, comprising,
balls located at a first level,
a magazine located at a second level,
means for lifting balls one at a time from said first level to said second level,
means for loading said lifted ball from said second level into said magazine,
means for ejecting said ball from said magazine,
said means for lifting balls comprises a hollow vertical section of pipe extending from said first level to said second level, and having an internal diameter slightly greater than the ball to be lifted; and
means providing a vacuum at one end of said pipe and a vacuum reducing hole on the side of the opposite end of said pipe whereby when a first ball is lifted past said hole, a second ball will not be lifted into said pipe.

2. A ball ejecting apparatus as defined in claim **1,** wherein said magazine is provided with a plurality of chambers each of said chambers being provided with a hole in their respective sides, a vacuum line being in operative relation with said hole in the side of said chamber, each of said chambers having a loading position during its operating cycle, whereby the vacuum in said vacuum line draws said ball from the lifting means into said chamber when said chamber is in the loading position.

3. A ball ejecting apparatus as defined in claim **2,** which is provided with a plurality of barrels each of said barrels being aimed in a slightly different direction, each of said barrels being axially aligned with a respective chamber and means for rotating said barrels in unison with said chambers in said magazine, whereby said balls are ejected through said barrels in a slightly different direction.

4. A ball ejecting apparatus as defined in claim **2,** which is provided with a barrel through which a ball is to be ejected, wherein said barrel is axially aligned with a chamber and said ejecting means.

5. A ball ejecting apparatus as defined in claim **4,** wherein said barrel is free to rotate about its longitudinal axis, and means for rotating said barrel in operative relationship with said barrel.

6. Apparatus for ejecting tennis balls, comprising:
means for generating air pressure for ejecting tennis balls;
means for generating a vacuum;
a reservoir for holding a plurality of balls at a first level;
means for lifting tennis balls one at a time from said reservoir to a second level regardless of the number of balls present in said reservoir;
a magazine containing a chamber having a loading position, said generated vacuum being operatively coupled to said chamber to suck tennis balls into said chamber from said second level when said chamber is in said loading position;
means for moving said magazine from said loading position to an ejection position whereby said tennis ball is ejected from said chamber when said chamber reaches the ejecting position.

7. A tennis ball ejecting machine as defined in claim **6,** wherein said magazine is provided with a plurality of chambers, a plurality of barrels, each of said barrels being aligned with a respective chamber in said magazine.

8. A tennis ball ejecting apparatus as defined in claim **7,** wherein said means for lifting tennis balls is provided with a source of vacuum to lift tennis balls, said ball lifting means comprising a vertical hollow pipe with the source of vacuum connected to one end of said hollow pipe, means for preventing more than one ball at a time from being lifted by said vacuum in said vertical hollow pipe, comprising a hole in the side of said hollow pipe, said hole being located at the other end of said hollow pipe.

9. A tennis ball ejecting apparatus as defined in claim **8,** wherein said means for rotating said magazine comprises a motor driving a friction gear, said friction gear riding in frictional engagement to the periphery of said magazine, and means for electrically controlling the speed of said motor connected to said motor.

10. An apparatus for ejecting tennis balls as defined in claim **9,** but further characterized by having a tennis table, said tennis table being provided with a trough for returning tennis balls to said ball lifting means.

11. An apparatus for ejecting tennis balls as defined in claim **10,** but further characterized by said ball return means having a jam preventing means, said jam preventing means comprising a trap door which permits balls to enter from one side at a time.

12. A table tennis ball ejecting machine comprising:
a means for creating a source of air pressure;
means for generating a source of vacuum;
a magazine provided with a plurality of chambers, each of said chambers being provided with a hole in its side;
means for lifting one tennis ball at a time;
means for rotating said magazine;
a table tennis ball loading position for said chambers in said rotating magazine;
a vacuum boot having a hole therein through which a suction is supplied to said chamber in said loading position, whereby a tennis ball is sucked into said chamber from said tennis ball lifting means;
means for supplying said source of air pressure to said chamber in the ejecting position to eject said table tennis balls;
means to seal the holes in the side of said chambers when said chambers are in the ball ejection position; and
a plurality of barrels, each of said barrels being provided with a respective chamber, said barrels being rotated in unison with said chamber.

13. A tennis ball ejecting machine as defined in claim **12,** but being further provided with a back cover for said magazine, said back cover having a hole for the loading position for said chambers, and a hole for the ejection position of said chamber.

14. A tennis ball ejecting machine as defined in claim 13, but being further provided with a front cover for said magazine, said front cover having a hole in the ball ejection position of said chamber.

15. A table tennis ball ejecting machine as defined in claim 14, but further characterized by having a clutch for disengaging the rotating barrels from the rotating magazine, whereby a single barrel is used for ejecting balls from each of said chambers.

16. A table tennis ball ejecting machine as defined in claim 15, but further characterized by having means for rotating said barrel about an axis running through the center of said barrel, whereby the rotating barrel adds a rotational component to the ejected table tennis ball.

17. A table tennis ball ejecting machine as defined in claim 12, but further characterized by having a clutch for disengaging the rotating barrels from the rotating magazine, whereby a single barrel is used for ejecting balls from each of said chambers.

18. A table tennis ball ejecting machine as defined in claim 17, but further characterized by having means for rotating said barrel about an axis running through the center of said barrel, whereby the rotating barrel adds a rotational component to the ejected table tennis ball.

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